Purpose: To investigate the utility and accuracy of high-sensitivity TLD for dosimetric characterization of low-energy brachytherapy sources.

Methods: One hundred high-sensitivity (TLD-100H) and 100 normal-sensitivity (TLD-100) TLDs were used in this study. The TLD-100s were annealed at 400oC for one hour and then kept at room temperature for 45 minutes followed by 80oC heating for 24 hours. To prevent temperature overshot from reducing the sensitivity of TLD-100Hs, a novel thermal reservoir was built, tested, and used to anneal TLD-100H at 240 0C for 15 minutes and then kept at room temperature for 45 minutes followed by 100 0C heating for one hour. These TLDs were then irradiated uniformly in a large cavity Cs-137 irradiator for biomedical research (Shepherd, Mark III) to test their reproducibility and to establish their relative sensitivities. The radial dose function of a Model AgX100 125I source was measured using both types of TLDs in water-equivalent solid phantoms as a test case. The radial dose function measured by the TLD-100H was compared with that measured by TLD-100 to determine its utility in brachytherapy dosimetry characterization.

Results: Consistent and accurate annealing of high-sensitivity TLDs was achieved by using a custom-built thermal reservoir system. TLD-100H was found to be about 18 times more sensitive than TLD-100. For a 125I source with a source-strength of 2.7U, the irradiation time for radial dose function characterization up to 7 cm can be cut down from 38 days to 3 days. The radial dose function measured by TLD-100H agreed well (within Â±6%) with that measured by TLD-100.

Conclusions: A novel thermal reservoir was used for consistent annealing of high-sensitivity TLDs. TLD-100H can significantly shorten the irradiation time needed for a complete characterization of radial dose function. Investigation of TLD-100H for complete brachytherapy source characterization is in progress.

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